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Foundation Mathematics

Topic 3 – Lecture 1: Solving algebraic equations using graphs

Presenting information in graphical form

Presenting linear equations in graphical form

Scope and Coverage

This topic will cover:

- Relationships between two variables as expressed in graphical form
- Presenting relationships as expressed in an algebraic equation in graphical form

Learning Outcomes

By the end of this topic students will be able to:

- Present a range of data in graphical form
- Present a range of linear equations in graphical form

Introduction to Drawing Graphs

- Presenting information which highlights the relationship between two variables such as

x	0	2	4	6	8
y	0	4	16	36	64

- For every increase in x there is an increase in the value of y (and of course as y increases so does x)

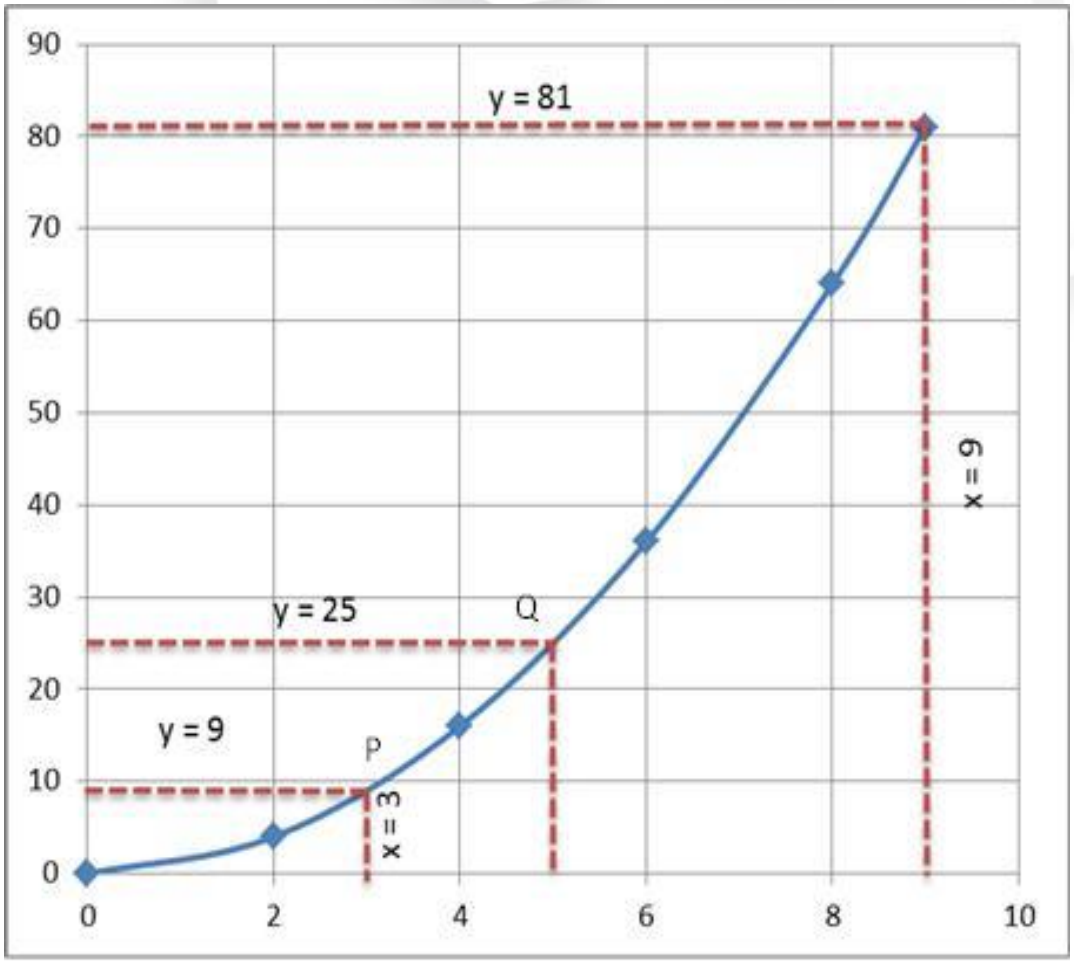
Basic Rules

- Basic rules for drawing graphs:
  - Values of x are always plotted along the horizontal axis and values of y along the vertical axis.
  - We need to chose a suitable scale for our axis

x	0	2	4	6	8
y	0	4	16	36	64

- If we now plot this information as a graph we get…

Plot Information



When a graph is either a straight line or smooth curve we can use the graph to deduce corresponding values of *x* and *y* between those given in the table (***interpolation***).

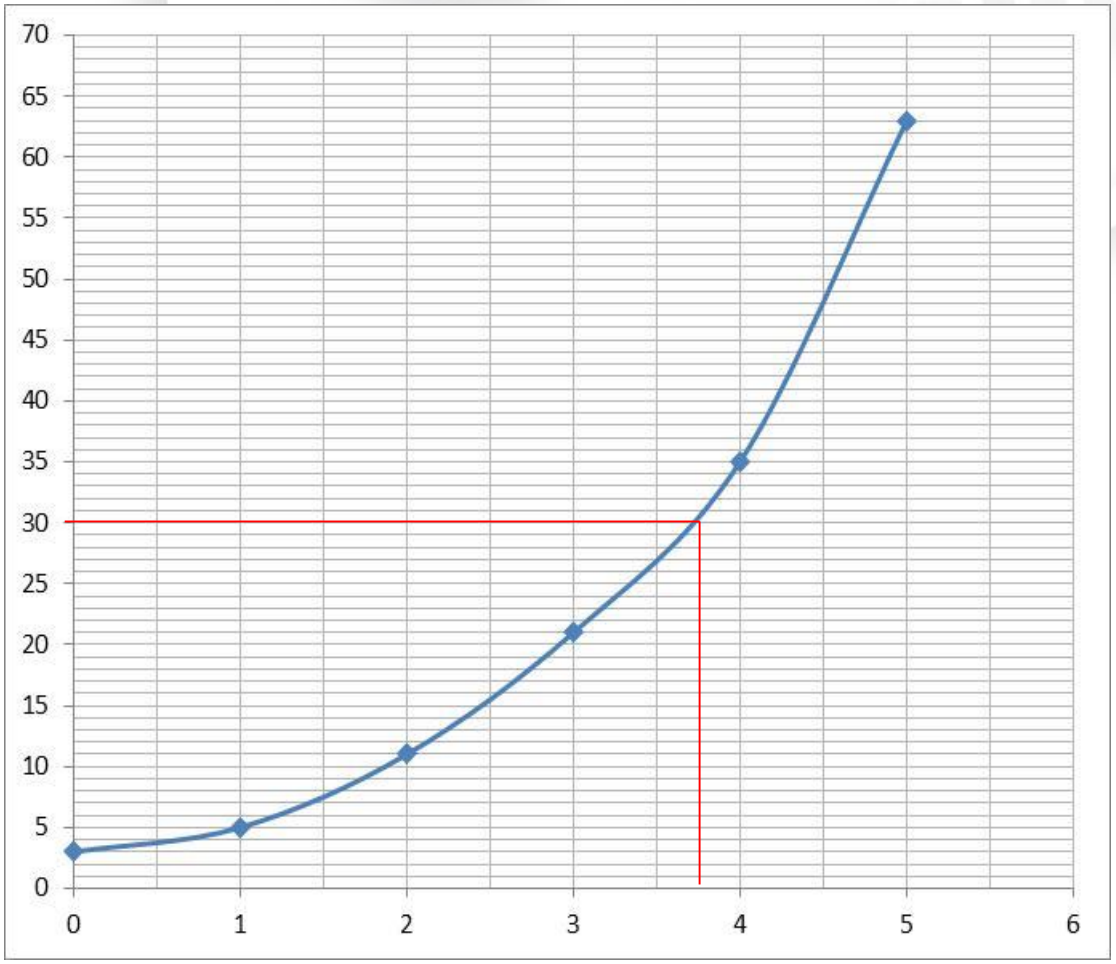
If we draw a horizontal line from y = 9 to our curve and then a vertical line to our x axis we can see that the value of x = 3. Therefore when y = 9 , x = 3

Drawing Graphs - 1

- The table below gives corresponding values of x and y. Plot a graph and from it estimate the value of x when y = 30.

x	*0*	*1*	*2*	*3*	*4*	*5*
y	3	5	11	21	35	63

Drawing Graphs - 2



Drawing our graph gives us this curve

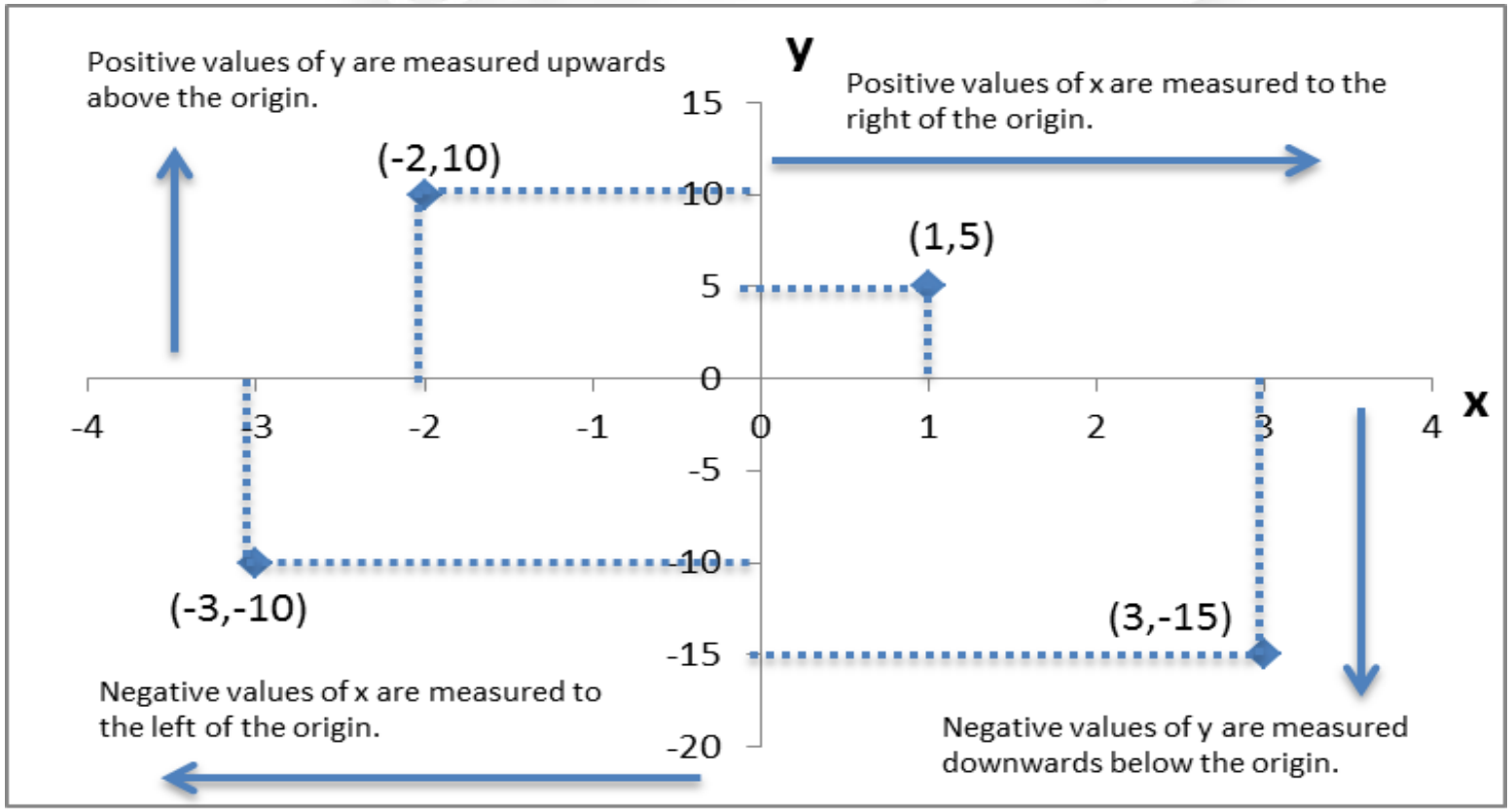
If we want to find our values we need to draw a horizontal line from the value on our y axis to our curve and then a vertical line to the x axis

Graphs of Simple Equations - 1

- Consider the simple equation y=2x+5
- Include any value for x
  - When $x = 0$ therefore y = $2x0+5=5$
  - When $x = 1$ therefore y = $2x1+5=7$
  - When $x = 2$ therefore y = $2x2+5=9$ and so on
- We therefore call **y** the ***dependent variable***. Since we can give x any value, we call ***x*** the ***independent variable***.

Graphs of Simple Equations - 2

- To represent equations we may have to include co-ordinates which are positive and negative.



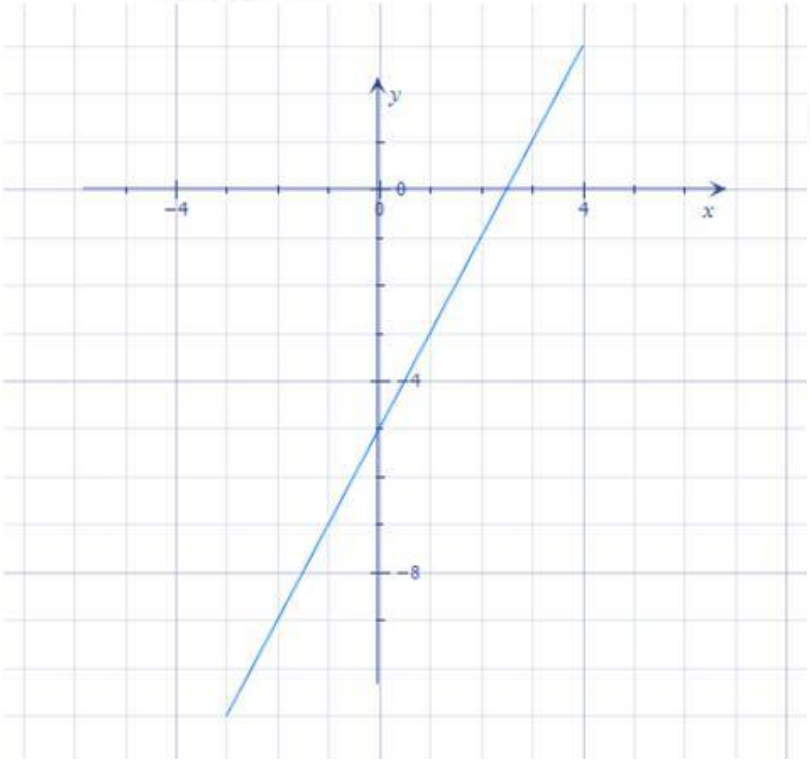
Graphs of Simple Equations - 3

- Example: Draw the graph of the equation y=2x-5 for values of x between -3 and 4.
  - As we are told that the range of values for x are between -3 and 4 we can substitute values of x into our equation to get values for y.
  - This is best done in a table

x	-3	-2	-1	0	1	2	3	4
$2x$	-6	-4	-2	0	2	4	6	8
-5	-5	-5	-5	-5	-5	-5	-5	-5
$y = 2x - 5$	-11	-9	-7	-5	-3	-1	1	3

Graphs of Simple Equations - 4

- From the table we can now plot our corresponding values of x and y in a graphical form



As we can see this graph gives us a straight line and would be referred to as a ***linear graph*** - therefore our equation is a ***linear equation***

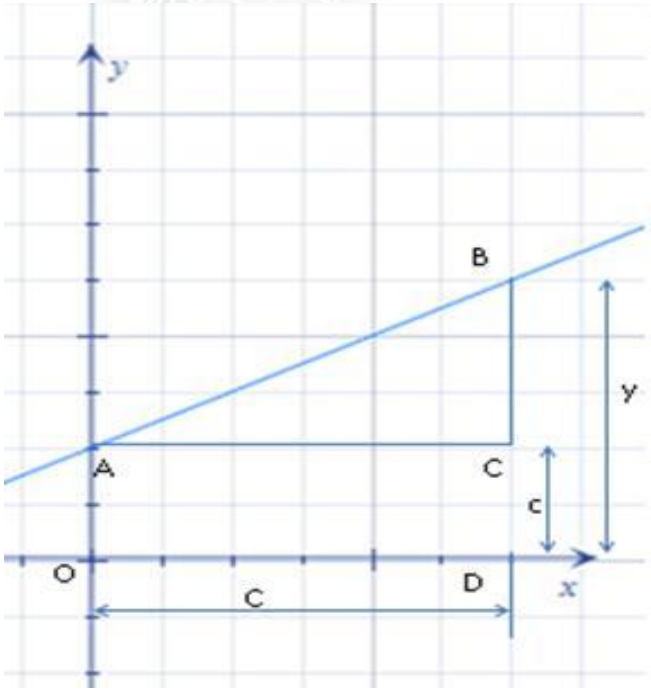
Equation of a Straight Line - 1

- Every linear equation may be written in the standard form $y = mx + c$
- This is known as the equation of a straight line
- Hence our equation $y = 2x - 5$ is in the standard form with $m = 2$ and $c = -5$
- The equation $y = 4 - 3x$ is also in the standard form but we need to rearrange it to make it more obvious therefore

$y = -3x + 4$ with $m = -3$ and $c = 4$

Equation of a Straight Line - 2

- Although we have given the equation of a straight line as $y = mx + c$, we have not yet identified what m and c actually mean.



The point B is any point on the straight line shown in our graph and it has the co-ordinates on the x and y axis.

Point A is where the line cuts the y axis and it has co-ordinates x=0 and y=c

$\frac{BC}{AC}$ is called the gradient of the line.

Equation of a Straight Line - 3

- Gradient is a measure of the steepness of the graph.
- Gradient can be defined as $\frac{\text{change in y}}{\text{change in x}}$

$= BC/AC = 3/6 = ½$

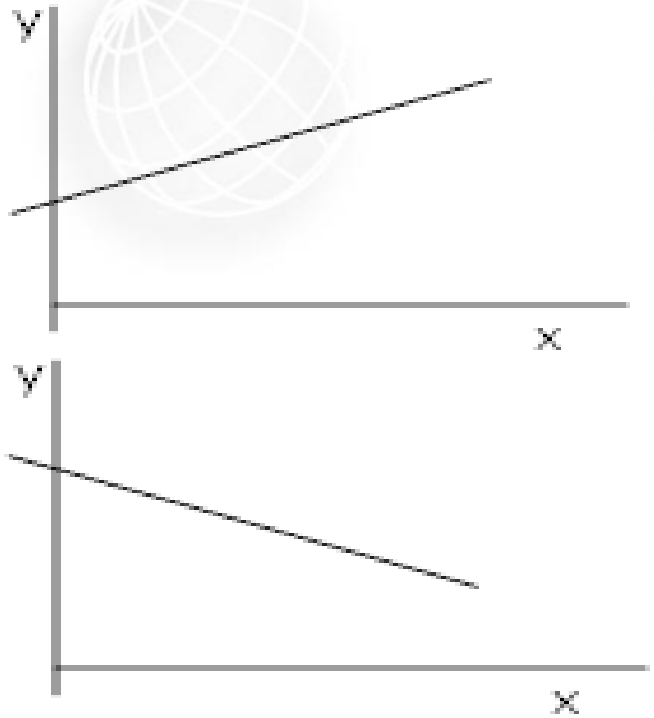
i.e. For every one unit across, the graph goes up ½ unit

- We can see that for y=mx + c,
  m = gradient of the line, c= intercept on the y axis

e.g. For the graph of y = 5x – 2, the gradient is 5 and the y-intercept is -2

Equation of a Straight Line - 4

- In the form y = mx + c it is possible to get a positive gradient or a negative gradient. It is worth nothing that the shapes of these graphs are relatively easy to identify



The positive gradient shows increases in both variables - as x increases so does y.

In a negative gradient one variable increases (in this case x) while the other (y) decreases.

Topic 3 – Solving Algebraic Equations using Graphs 1

Any Questions?

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